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(54) HYGIENIC VACUUM CLEANER WITH A CIRCULATING AIR FLOW

(70) Loetkeman, Henry, St. Catharines, Ontario, Canada

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166,255


ABSTRACT

It is known that vacuum cleaners for use in households collect dust by a suction act and discharge the used unclean air into the surrounding area which represents a common disadvantage of the suction method.

The quality of the cleaning action depends on strength and velocity of an air flow which occurs as a result of pressure differential between nozzle interior and the ambient air. The strength of this cleaning air flow depends on two factors: on the constant atmospheric pressure of the ambient air, which cannot be increased and on the artificial created vacuum condition, which can be improved. But when the lower vacuum pressure is created the more complicated and more expensive it becomes to maintain such improved vacuum. This is also a disadvantage of the suction method.

This invention represents a pneumatic cleaning device for use in households which rejects the outlet of used air into the surrounding area and employs a circulation in a closed loop air flow in order to avoid air pollution with fine dust particles, bacteria, odor, etc. It also eliminates disturbance and rise of dust adjacent the outlet and substantially improves the cleaning action by creating an independent powerful air flow. The nozzle in this closed system represents simply an enlargement of the air passageway with a baffle in the nozzle interior to alter flow direction of the circulation air flow which at the open part of the nozzle, sealed against surface under treatment, contact this surface, engage dust particles, dirt, etc., and carries them into the filter bag of the fan housing.


H. Loetkeman.

H. Loetkeman

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CLAIMS

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1 A mobile air recirculating cleaning device for use in households which distinguish from ordinary vacuum cleaners consists of the replacement of the suction action by a circulation air flow and abolition of discharging used air into the surrounding area; it comprises an independent from the atmospheric pressure circulating in a closed loop air flow, a nozzle for contacting and travelling over a flat surface to be cleaned in substantial air sealing engagement therewith comprising an enlargement of the air passageway of the closed loop fashion conduit, including a baffle in the nozzle interior for alteration of air flow direction and coaxially arranged air inlet and air outlet located at one side of the nozzle; a one-piece connection between said nozzle, two air conduits, and fan housing, comprising a flexible conduit having two separate ducts therein for detachable connecting the combined air inlet and air outlet of the nozzle, having concentric circular orifices, to the combined air inlet and air outlet of the fan on the housing, and an air cooling compartment on the housing.

2 A mobile air recirculating cleaning device for use in households as claimed in claim 1 wherein said air inlet and air outlet of the fan housing and on said nozzle, respectively, are concentric circular orifices in which said combined flexible conduit is by a pivoting joint detachable connected, thus said nozzle, in spite of its connection to two air conduits, is able free to revolve about an axis without interrupting the constant circulating air flow.

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3 A mobile air recirculating cleaning device for use in households as claimed in claim 2 wherein the ducts of said combined flexible conduit are disposed co-axially one within the other, thus they represent a one-piece connection between said combined air inlet and air outlet of the nozzle and said combined air inlet and air outlet of the fan housing, and the air flows in the inner and in the outer duct, but in opposite directions.

4 A mobile air recirculating cleaning device for use in households as claimed in claim 2 wherein the nozzle has an enlongate opening in a single plane for contacting and substantially sealing the nozzle against surface under treatment; and said combined inlet and out let of said nozzle is provided with a curve shaped, pivoting connection joint, comprising two co-axially arranged parts with concentric circular orifices, to which said combined air conduit is detachable connected, and the nozzle is able to revolve about an axis changing thereby its working position under various angles in relation to said combined air conduit.

5 A mobile air recirculating cleaning device as claimed in claim 1 wherein the nozzle includes a baffle for alteration of air flow direction dividing the interior of said nozzle into two compartments in which the air flows in opposite directions, the first compartment bounded by said baffle and surface under treatment is connected to said nozzle outlet, the second compartment is connected to the inlet of said nozzle and represents an air passageway which is connected by a number of channels to the said first compartment, thus the directed toward nozzle outlet air flow first contact the surface under treatment in the form of a plurality of single air streams, and then unite to a compact dust laden air blast toward nozzle outlet.

6 A mobile air recirculating cleaning device for use in households as claimed in claims 4 or 5 wherein said nozzle inlet and said nozzle outlet are located at one side of, and intermediate the ends of, said enlongate opening with their axis disposed at right angles to the longitudinal axis of the enlongate opening and substantially parallel to the plane of the opening, and the nozzle includes a baffle extending from said nozzle inlet across said opening and terminating short of the margin of the opening remote from the nozzle inlet.

7 A mobile air recirculating cleaning device for use in households as claimed in claims 5 or 6 wherein the air streams issuing from said channels into said first compartment of the nozzle interior are directed toward said nozzle outlet with a slight inclination toward surface under treatment; to avoid collision between opposing air flows, said channels occupy only approximately sixty (60) percent of the circumference of said enlongate nozzle opening for contacting surface under treatment.

8 A mobile air recirculating cleaning device for use in households wherein the suction action of ordinary vacuum cleaners is replaced by an independent circulation air flow in a closed loop with abolition of discharging used air into the surrounding area; it comprises a nozzle including a baffle in its interior for alteration of air flow direction and combined air inlet and air outlet located at one side of the nozzle, and flexible co-axially arranged air conduits, a concentric circular arrangement of the combined air inlet and air outlet on said nozzle and on the fan housing, wherein the flat bottom of the housing is provided with an external air cooling compartment comprising of an embossed metal sheet and an air passageway

between said bottom of the housing and said embossed metal sheet.

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## SPECIFICATION

This invention relates to a pneumatic cleaning device for use in households.

It is known that ordinary vacuum cleaners collect dust by a suction act and discharges the used unclean air into the surrounding area. The cleaning action is performed by a steady air flow created by a pressure differential between nozzle interior and the ambient air. This air flow engages dust particles, dirt, etc., and forces them to be drawn into the interior space of the nozzle and filter bag.

It is obvious that the quality of the cleaning action depends on strength and velocity of this air flow. The only way to increase the velocity and strength of the air flow by suction devices is to increase the pressure differential between the ambient air and nozzle interior. The strength and velocity of this air flow depends on two factors: on the constant atmospheric pressure of the ambient air, which cannot be increased, and on the artificially created vacuum, which can be improved by employment of a more powerful fan; but, the lower vacuum pressure is created, the more complicated and more expensive becomes to maintain such improved vacuum because an improvement of the vacuum condition increases the velocity of the air flow, and an intensified air flow aspires also to impair the vacuum condition, which is a disadvantage of the suction method. Another disadvantage is that the discharged air usually contains dust particles, bacteria, odor, etc. and it also disturbs dust adjacent to the outlet which settles on surrounding objects, i.e. creates air pollution. Although employment of supplementary filters and exhaust compartments



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reduces air pollution to a certain degree, the air flow issuing from the outlet, after passing the filter bag with accumulated dust, still is unclean and unhygienic.

It is known to provide suction devices also with blowing nozzles, acting in cooperation with the suction nozzle, i. e. the air blast is used
3 to disturb dust and the dust laden air is drawn into the suction nozzle by a suction act. Usually the blowing nozzles create opposing air flows, and in addition, the air flows issuing from the blowing nozzles are directed not toward the outlet from the interior of the cleaning head or nozzle, but in some cases, are directed vertical to the surface being cleaned. The result of such arrangement is that the air flows lose its speed and strength by collision between opposing air flows and by collision with the surface under treatment and produces air whirls which create in the nozzle interior an uncertain condition of the air which must be set in motion again in a certain direction by suction means. Part of the air blast escapes into the
4 atmosphere and creates pollution, and air from the outside is drawn into the suction nozzle. Such arrangement does not increase the strength of the air flow and does not eliminate the outlet of unclean air into the surrounding area. Another disadvantage is that the cleaning head includes relatively large air distribution chambers which makes the cleaning head or nozzle quite unsuitable and useless for household cleaning, to fit under furniture, etc., which requires a low profiled mobile nozzle, detachable connection to the blower by flexible conduits.

I have found that the above mentioned disadvantages of the suction method may be overcome by the employment of a circulation in a closed

loop air flow in order to avoid the discharge of unclean air into the surrounding area and to improve the cleaning action by an independent powerful air flow.

Since a circulation in a closed loop air flow is independent from the pressure of the ambient air, the velocity and strength of such air flow can easily be increased to attain a high effective cleaning action. The circulating air flow is created by setting in motion the air which contains the system before starting to work. The nozzle itself represents simply an enlargement of the air conduit with an opening sealed against the surface under treatment. The inlet side and the outlet side of the fan, both connected to the nozzle interior, and the air flow is transformed within the nozzle into single, suitable directed air streams which at the open part of the nozzle contact the surface being cleaned and then unite to a compact dust laden air blast toward the nozzle outlet, which by an air conduit is connected to the filter bag.

The cleaning device is provided with uniquely arranged combined air conduits wherein the ducts are disposed co-axially one within the other which makes it possible to create a one-piece connection between nozzle and two air conduits which allows the nozzle to freely revolve about an axis and changing its working position without interrupting the constant circulating air flow. Of course, it would be possible instead of co-axially disposed ducts, to use parallel arranged dual ducts, connected to the air inlet and the air outlet of the nozzle, but such arrangement would be uncomfortable to manage and the nozzle itself loses a substantial part of its mobility.

In drawings which illustrate the invention:

Figure 1 is a diagrammatical illustration of the circulation air flow;

Figure 2 is a section on the line I-I of figure 6 and illustrates the arrangement of nozzle means and formation of directed air blast within the nozzle;

8 Figure 3 shows arrangement of combined air conduit and principle of connection;

Figure 4 is a section on the line A-A of the combined air conduit;

Figure 5 is a side view of the fan housing shown in section;

Figure 6 is a diagrammatical illustration of the nozzle interior, arrangement of directed air streams toward nozzle outlet and combined inlet and outlet of the nozzle;

Figure 7 is an illustration of the curve-shaped pivoting connection joint.

The cleaning device comprises: a motor driven fan 1, a housing 10, combined inlet to the fan 1 and outlet from the fan 1 on the housing 10, a

9 filter bag 7, a cooling compartment 2, combined air conduit with co-axially disposed ducts 4/6, a nozzle 5, for contacting and travelling on a flat surface 9, an inlet 4' and an outlet 6' on the nozzle 5, air channels 8 within the nozzle 5, an inclined wall 12, a spring loaded brush 13, a connection joint 11.

The nozzle inlet 4' is connected to the fan outlet, and the nozzle outlet 6' is connected to the fan inlet by the co-axially arranged air conduit 4/6. The axis of the nozzle outlet and inlet is disposed substantially parallel to the plane of the nozzle opening and to surface under treatment and the dustladen air blast flows along the inclined toward nozzle



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outlet 6' wall 12, sealed by a spring loaded brush 13 against the surface 9, in to said nozzle outlet 6'.

In order to improve the cleaning effect by deep penetration into surfaces like pile carpets, shaggy rugs, etc. to disturb and to lift dust particles which may be penetrated deep into the material, the compact air flow issuing from the nozzle inlet 4' is by channels 8 divided into a plurality of single concentrated and suitable directed air streams, thus the air flow issuing from the channels 8 first contact the surface 9 in the form of a plurality of single air streams and then unite to a compact dust laden air blast toward nozzle outlet 6'.

Figure 2 illustrate an example of arrangement of nozzle means with directed air flow and may be modified according to application. The nozzle interior is by a baffle divided in two compartments (I and II) in which the air flows in opposite direction, the first compartment I bounded by the baffle and surface under treatment 9 is connected to nozzle outlet 6', the second compartment II is connected to the nozzle inlet 4' and represents an air passageway which by a number of channels 8 is connected to the first compartment I of nozzle 5.

Figure 2 and figure 6 illustrate also the main principle of formation of the directed air flows within the nozzle 5. The air streams issuing from the channels 8 into the first compartment I are directed toward nozzle outlet 6' with a slight inclination toward surface under treatment 9. The channels 8 occupy only three sides, or approximately sixty (60) percent of the orifice of the enlongate open part of nozzle 5 in order to avoid



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collision between opposing air flows which would substantially reduce velocity, and strength of the directed air flow and impair the cleaning action.

The combined air conduit 4/6 comprises two tubes (wands) and two flexible hoses disposed co-axially one tube within the other and one flexible hose within the other thus the air flows in the inner and in the
13 outer duct, but in opposit directions. The connection between nozzle 5 and combined air conduit 4/6 is made by a universal curve shaped pivoting joint 11 (Fig. 7), comprising two co-axially arranged parts having concentric circular orifices. As it is well known, the employment of a pivoting joint with curved shape, to connect the wands to the nozzle, makes possible easily to change working position of nozzle by a slight turn of the wand around its longitudinal axis. However, this is possibly only in the case of a one-piece connection between nozzle and air conduit. Therefore, in order to create a one-piece connection between two air conduits (4 and 6) and nozzle 5, the flexible conduit as well as the wands,
14 have a co-axially arrangement and concentric circular orifices.

If an air flow is forced to circulate steady in a closed loop fashion system, the temperature of the air begins to rise, therefore the flat bottom of the housing 10 is provided with a cooling compartment 2, comprising an embossed metal sheet (not shown), and the air from the fan outlet flows through a small space between housing bottom and the embossed metal sheet, after which the air flow is directed by a connection conduit (see Fig. 1) into the duct 4.



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Fig. 1

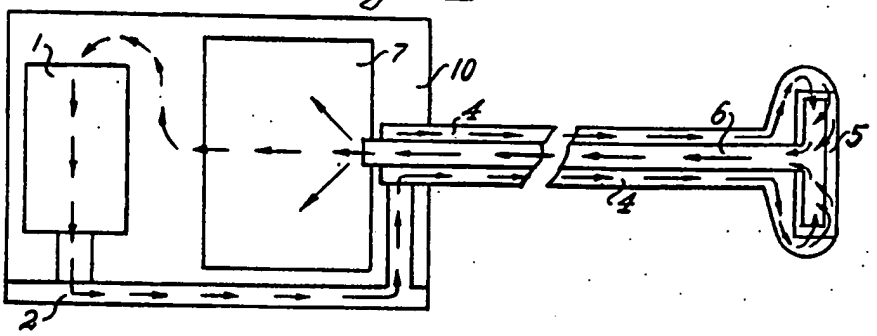


Fig. 2

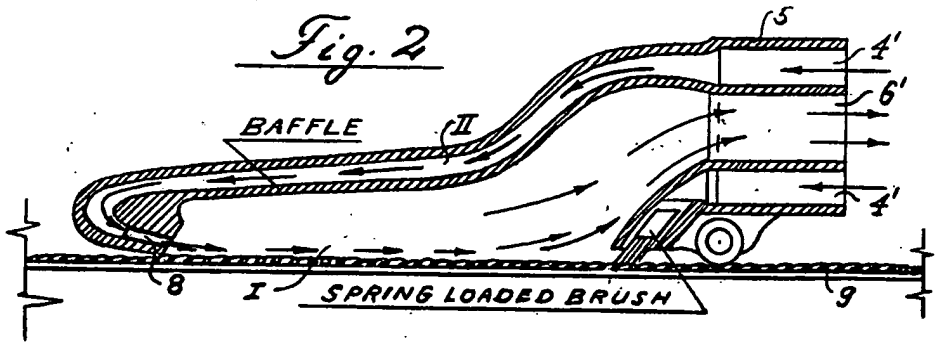


Fig. 3

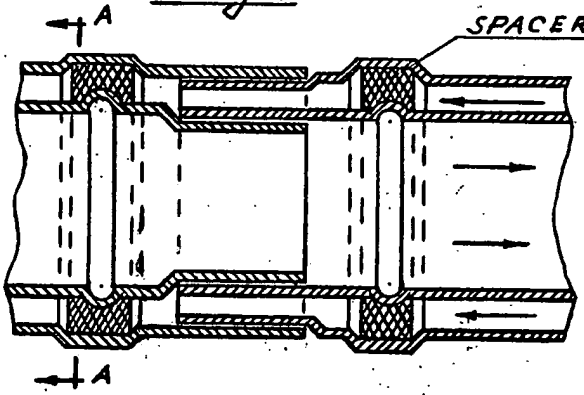


Fig. 4

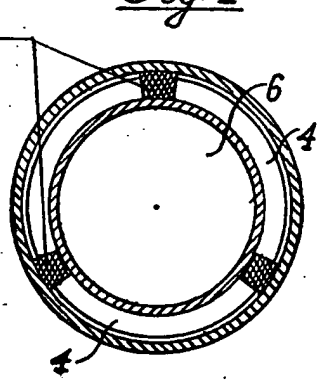


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Fig. 5

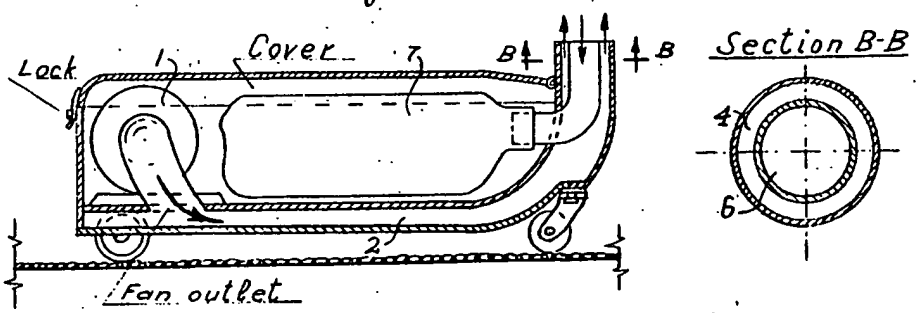



Fig. 6

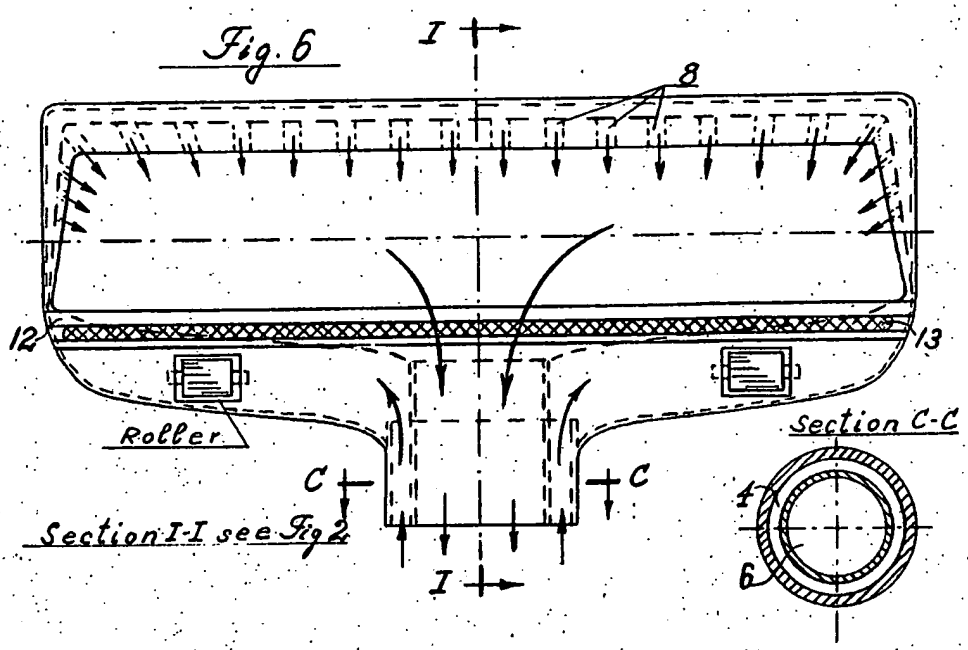
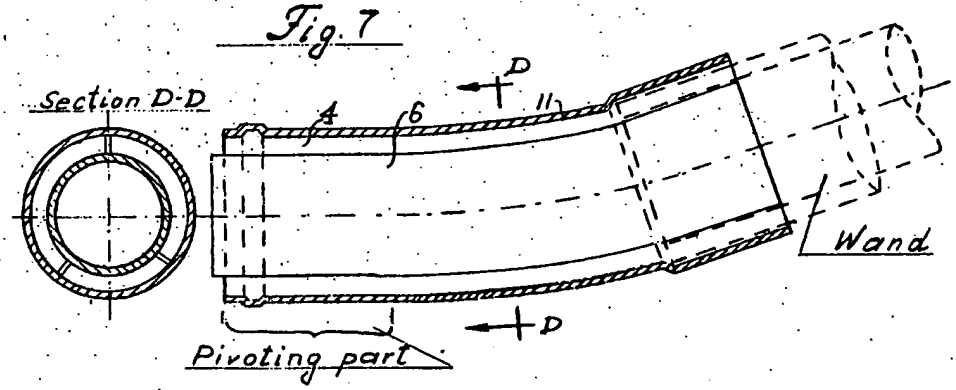



Fig. 7

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